



Ministry of Industry and Trade



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Zusammenarbeit (GIZ) GmbH

On behalf of:



Federal Ministry  
for the Environment, Nature Conservation  
and Nuclear Safety

of the Federal Republic of Germany



# Bioenergy potential in Viet Nam: Solutions from agriculture sector to meet COP26 commitments

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GIZ Energy Support Programme*



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- Bioenergy in agriculture
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# Bioenergy from agriculture

## I. Plant farming

- ❖ Rice: rice straw, rice husks
- ❖ Corn: seeds, stems, leaves, cobs
- ❖ Cassava: tubers, stems, leaves, dregs, peels
- ❖ Sugarcane: stems, top, leaves, bagasse, filter cake, molasses
- ❖ Peanut: nuts, stems, leaves, shells, meal

## II. Animal husbandry: solid and liquid waste of livestock and poultry

## III. Forestry: wood, twigs, chips, sawdust, etc.

## IV. Processing

- ❖ Arrowroot: residues, wastewater
- ❖ Tapioca: residues, wastewater
- ❖ Rice noodle: wastewater
- ❖ Slaughter: solid waste, wastewater
- ❖ Fishery: residues, wastewater

# Current status of biofuel crop production in Viet Nam

No.	Category		Unit	Implementation	
				2016	2020
1.1	Rice	- Area	1,000 ha	7,737.7	7,364
		- Capacity	Quintals/ha	55.80	58.94
		- Yield	1,000 tons	43,165.1	43,400
1.2	Corn	- Area	1,000 ha	1,152.6	980
		- Capacity	Quintals/ha	45.52	48.06
		- Yield	1,000 tons	5,246.5	4,710
2.2	Cassava	- Area	1,000 ha	569	520
		- Capacity	Quintals/ha	191.73	200.56
		- Yield	1,000 tons	10,909.7	10,429.3
4.1	Peanut	- Area	1,000 ha	199.4	170
		- Capacity	Quintals/ha	23.3	26
		- Yield	1,000 tons	463.6	442
4.2	Soybean	- Area	1,000 ha	84.60	50
		- Capacity	Quintals/ha	14.69	15.2
		- Yield	1,000 tons	124.3	76
4.3	Sugarcane	- Area	1,000 ha	267.7	245
		- Capacity	Quintals/ha	642.8	644.95
		- Yield of sugarcane	1,000 tons	17,210.1	15,801.2
1.1	Coffee	- Total area	1,000 ha	650.50	686
		- Area for business	1,000 ha	635.13	630
		- Capacity	Quintals/ha	24.44	24.77
		- Yield of raw coffee beans	1,000 tons	1,460.8	1,699

# Capacity of products and residues of some crops (2019)

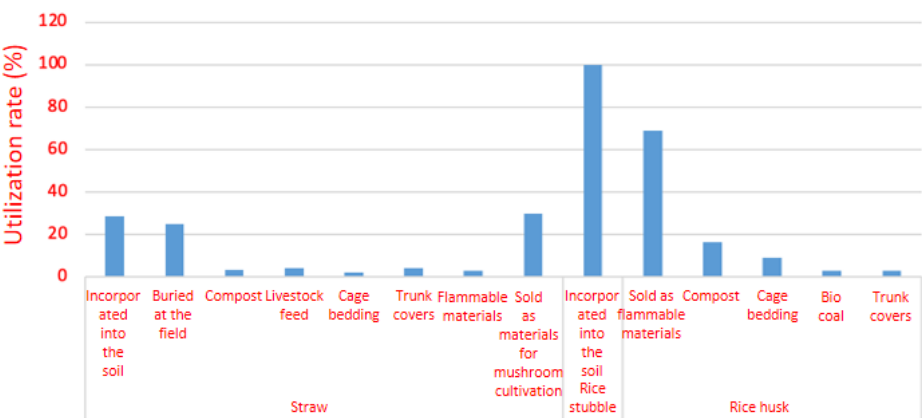
	Capacity of products and residues (million tons)						
	Rice	Corn	Peanut	Soybean	Cassava	Sugarcane	Coffee
Seed/plant/tuber	45.2	5.3	0.42	0.076	10.2	18.3	1.4
Straw	45.2						
Rice husk	8.8						
Stem		10.4	0.42	0.076			
Corn cob		1.4					
Top and leaf					3.7	9.9	
Cassava stem					4.0		
Fiber & bagasse					2.0	8.5	
Tuber peel					0.3		
Twig							5.8
Skin							3.5
Grounds							1.3
<b>Total residues</b>	<b>54.02</b>	<b>11.8</b>	<b>0.42</b>	<b>0.076</b>	<b>10.0</b>	<b>18.4</b>	<b>11.6</b>

# Current status of agricultural residues

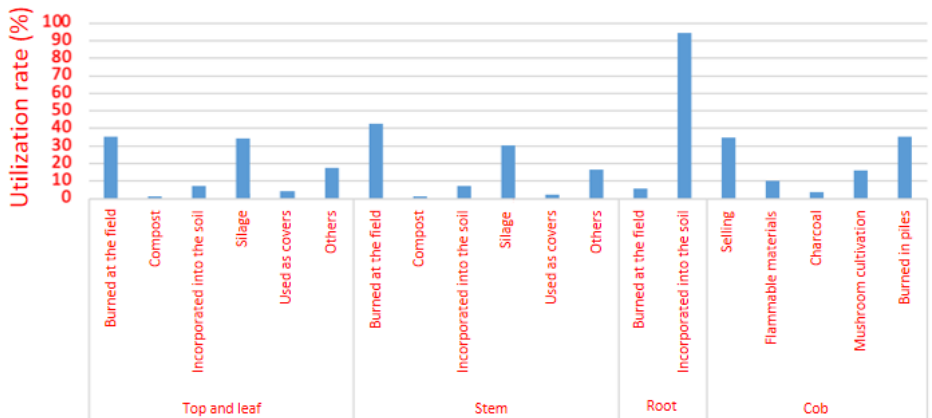


# Current status of agricultural residues

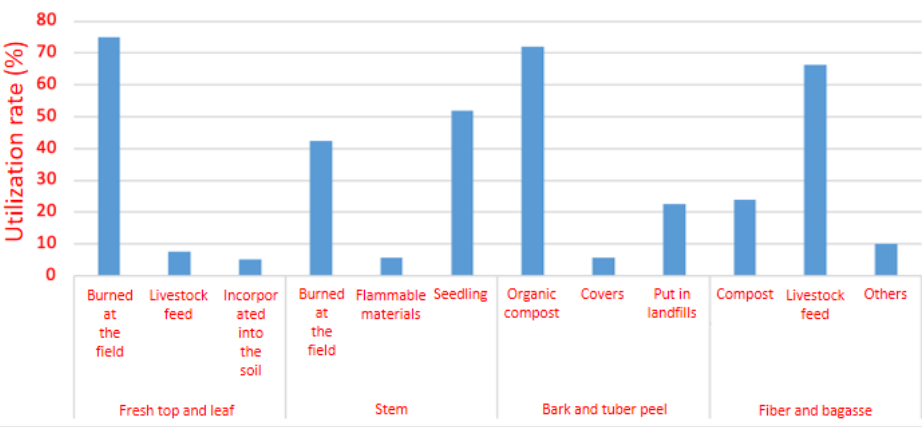
### Rice residues



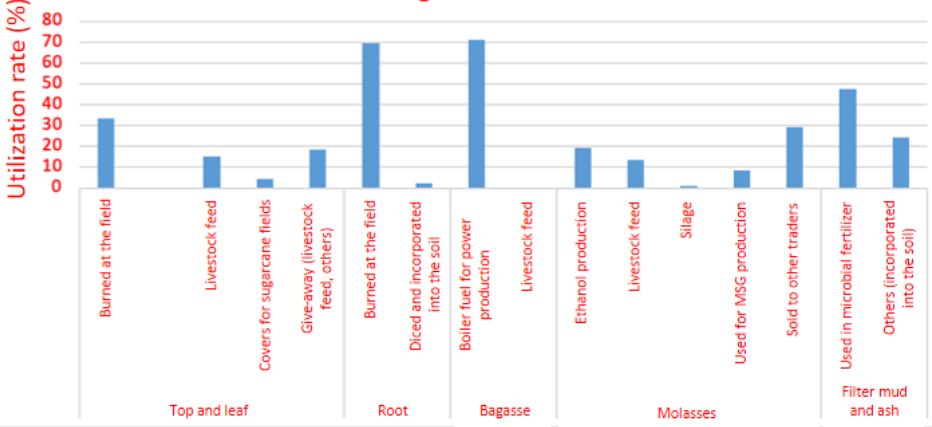
### Corn residues



### Cassava residues



### Sugarcane residues



# Bioenergy potential of agricultural residues

- **Calorific value of some key residues**

No.	Type of residue	Calorific value	
		kWh/ton	MJ/ton
1	Wood	4.07	14,650
2	Wood waste	3.72	13,392
3	Rice husk	3.49	12,564
4	Rice straw	3.26	11,736
5	Bagasse	2.15	7,740
6	Biogas (m <sup>3</sup> )	6.0	21.6
7	Ethanol (m <sup>3</sup> )	5.86	21.1
8	Husk briquette	5,233.5	18,840.6
9	Wood pellet	5,582.4	20,096
10	Other biomass	3.49	12,564



# Animal husbandry and the amount of waste from animal husbandry

Livestock	Solid waste, kg/animal/day			Liquid waste, kg/animal/day		Average per herd (2016-2020) 1,000 animals	Total amount of waste (million tons)	
	(1)	(2)	(3)	(2)	(3)		Solid	Liquid
<b>Pig</b>	2.5	1.2-3.0	2.3	4-6	3.5	27,283	24.90	49.79
<b>Poultry</b>	0.02	0.02-0.05		-		420,336	3.07	-
<b>Cow</b>	10.0	15-20		6-10		6,024	26.20	17.59
<b>Buffalo</b>	15.0	18-25		8-12		2,481	17.70	9.06
<b>Goat and sheep</b>	1.5	1.5-2.5		0.6-1.0		-	-	-
<b>Total</b>							71.87	76.44

# Biogas potential from animal husbandry

Number of main livestock, amount of livestock waste and potential biogas production in 2019

Livestock	Number of animals	Amount of waste	Total amount of waste	Percentage of volatile solids (VS)	Methane potential (Bo)	Biogas energy production (BEP)
	1,000 animals	Kg/ day/ animal	million tons/ year	Kg/ animal/ day	m <sup>3</sup> CH <sub>4</sub> / kg	m <sup>3</sup> / year
Pig	19,615.5	2.5	49.0	0.3	0.29	15,572.3
Buffalo	2,387.9	15	35.8	3.9	0.1	8,498.0
Cow	6,060.0	10	60.6	2.8	0.13	20,128.3
Poultry	481,079	0.2	96.2	2.3	0.1	1,009,664.5
<b>Total</b>						<b>1,053,863.1</b>

# Number of biogas systems built in Viet Nam

No.	Biogas technology	Number of works by scale (digester)	
		Household	Farm (medium and large)
1	KT1 and KT2 designs	201,469	4,032
2	Composite	89,147	2,390
3	Other types (biogas lagoons with HDPE and PE covers, other types of construction and recycled plastics, etc.)	159,384	8,948
	TOTAL	450,000	15,370

Advantages: Solutions to environmental pollution, and reuse of energy

Shortcomings:

- Low energy utilization rate, difficulties in grid connection
- Instability, dependence on livestock, markets, epidemics, etc.
- Unclear mechanisms

# Some barriers to the development of biofuel crops

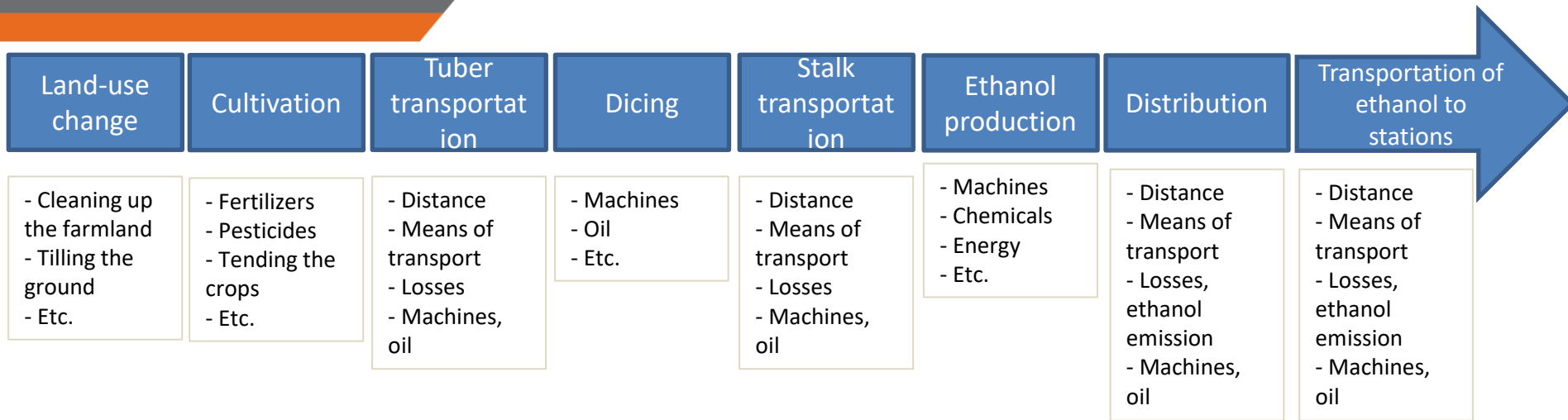
1. Actual amount of collected agricultural residues is lower than estimation
2. Difficulties in and high costs of collection => high prices
3. Unstable income => the tendency to change crops
4. Land degradation (erosion, soil damages, etc.)
5. Competition with imported products: Import prices are lower than domestic prices
6. Change to crops with higher value and better marketability: rubber, pepper, fruit trees
7. Competition in usage: biomass feedstock for animal husbandry
8. Government policies have not substantially encouraged the development of biofuels yet.

# Some barriers to the development of biofuel crops

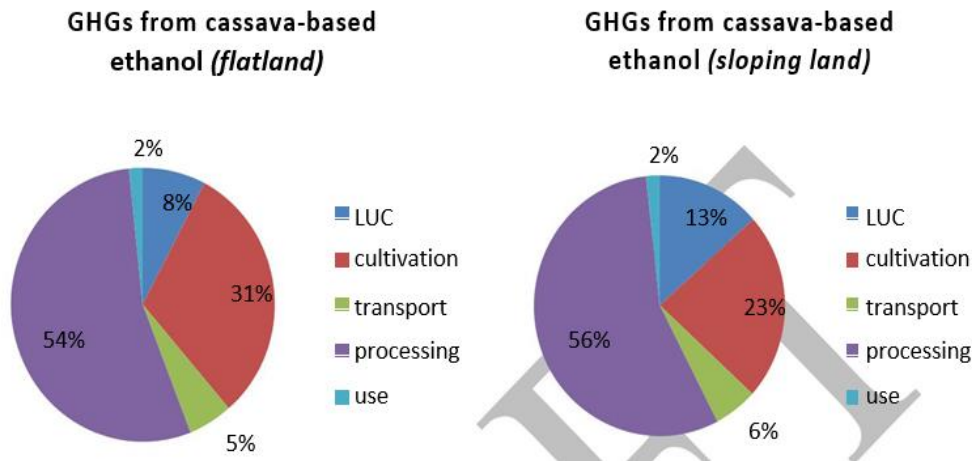
9. Local development policies: Son La has replaced corn with fruit trees, vegetables, etc.
10. Pests: cassava mosaic disease (>40,000 ha in 2018), fall armyworm (>15,000 ha of corns in 2019)
11. Biogasoline is not popular
12. Levels of technology and equipment
13. Quality of human resources
14. Limited investment, research and implementation
15. Legal issues and international cooperation
- 16. Joint plans between MOIT and MARD**



# Life-cycle assessment of ethanol production from cassava in Viet Nam



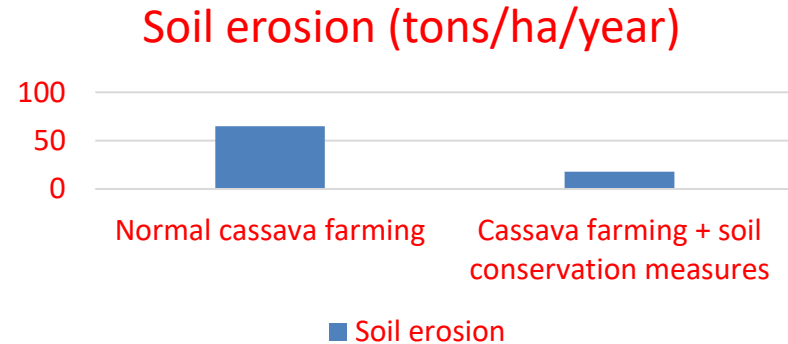
## Greenhouse gas emission rate during production life cycle



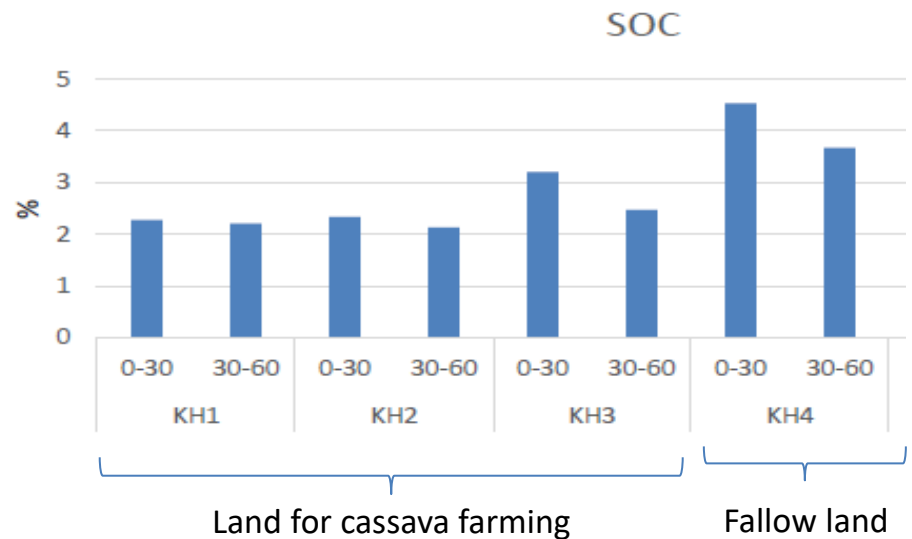
Source: Institute for Agricultural Environment (2017)

# Impacts on soil quality

Soil erosion



Soil fertility decline



Source: Institute for Agricultural Environment (2017)

# Solutions

1. Short-term and long-term policies on developing biofuel crops, linking production with processing, and stabilizing output and prices of biofuel crops;
2. COP26 commitment => sectoral targets => sectoral tasks => planning and master planning
3. Balance between food - foodstuff - energy security => long-term planning of production areas
4. Close cooperation between the Ministry of Industry and Trade and the Ministry of Agriculture and Rural Development
5. Review and revision of provinces and ecological regions' master plans



# Solutions

7. Transfer of advanced technologies (cultivation and preliminary processing) to optimize production and boost efficiency
8. R&D investment: seeds, cultivation, fertilizers, collection, treatment, and reuse of by-products, etc.
9. Consistent production infrastructure from plants to fields, transportation
10. Stabilization and support for output of biofuels from agriculture, connection of biogas power to the grid, connection to carbon market

# Thank you!

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